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EXAMINER

SOUW, BERNARD E

ART UNIT PAPER NUMBER

2881

DATE MAILED: 06/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/758,172

Applicant(s)

GROENEVELD ET AL.

Examiner

Bernard E Souw

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4-12, 18 and 20 is/are allowed.
- 6) ☒ Claim(s) 1-3, 13-16, 17 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Applicant's Amendments

1. The Amendment B, Paper No. 7/B, filed on 03/18/2003, has been entered. The present Office Action is made with all the suggested amendments being fully considered.

New claims 17-20 have been added..

Therefore, claims 1-20 are pending in this Office Action.

Non-Compliance

2. The Response submitted with the Amendment B filed 03/18/2003 (Paper no. 7?B) is Non-Compliant to the objections and rejections raised by the examiner in the previous Office Action dated 11/15/2002, to which Applicant's Response is supposed to respond.

- ▶ Regarding the previously objected Preliminary Amendment, while the insertion mistakes as indicated for page 5 and page 8 have been adequately corrected, requested corrections to pages 3, 5, 10, and 16 have not been addressed.
- ▶ Regarding the objection made to the foreign priority document, the newly submitted front page of the previously submitted copy of European patent Application 00300246.6 filed in Europe on 01/14/2000 is **not a certified copy**, but just a copy of a certified document. Such a copy is only acceptable if the present Application is a national stage of PCT applications. For all other foreign applications, a certified copy is

needed (i.e., with **original** seal of the foreign Patent Office and/or **original** signature of the issuing Patent Officer).

Response to Amendment

3. Applicant's remark regarding the allegedly incorrect date of Applicant's preliminary Amendment (Paper no.3) recited in the previous Office Action is a mistake. Although the Pre-Amendment was received on 01/21/2001, it has not been entered (as Paper no.3) until 04/16/2001. Thus, Applicant's document has been *correctly identified and addressed* by the Examiner.

Response to Applicant's Arguments

4. Applicant's arguments filed 03/18/2003 (Paper No.7/B) have been fully considered. The following is the Examiner's response to Applicant's arguments.

► Regarding claim 1, Applicant's argument on page 7, lines 4-5 from bottom, that Nishi-342 "*is merely concerned about displacement errors due to rotation about the Z axis and not tilting of the XY plane*" is a grave misunderstanding of the cited prior art. Nishi-342 is not merely concerned about rotation about the Z-axis as alleged by Applicant, but **also** about tilting of the XY plane, as unambiguously expressed in Col.8/ll.16-25. Therefore, Applicant's argument regarding the rejection of claim 1 is unpersuasive.

- ▶ Regarding claims 3 & 13, and 4-8, Applicant's argument is *solely* based on the same wrong argument as previously applied to claim 1. Therefore, Applicant's arguments regarding the rejection of claims 3 & 13 and 4-8, are also unpersuasive.
- ▶ Regarding claims 2 and 9-12, Applicant's argument is partly based on the same argument as previously refuted with regards to claims 1, 3, 13 and 4-8. Therefore, Applicant's *specific* arguments regarding the rejection of claims 2 and 9-12, are also unpersuasive.
- ▶ Regarding claims 14, 15 and 16, Applicant's argument is partly the same as the previously refuted argument regarding claim 1 (Nishi-342's invention allegedly not tilting of the XY plane). As to Applicant's further argument that neither Murata nor Ota nor Yamamoto measures a position of a reference point on the surface of the object table, it is noted that the limitation of a reference point is disclosed by Nishi-342, i.e., reference point FM on item labeled 15 in the reference plane 9, as disclosed in Col.5/ll.40-45. This reference point has been already recited in the previous Office Action with regard to claim 3 (page 5), and is repeated in the present Office Action.

By attacking Murata, Ota and Yamamoto, while completely ignoring Nishi-342, the latter having been applied in the previous rejection of claim 3, Applicant is trying to argue against the references individually. It is to be emphasized that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references (over Nishi-342 in view of Murata, Ota and Yamamoto). See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Moreover, Applicant's argument that Murata is "*silent about detecting displacements of a reference point of the second object table at various angle tilt when*

situated at a measurement position" is quite ridiculous, because the above citation from Applicant's own argument (printed in *italics* between quotation marks) is nothing else than a *conventional* definition of Abbe's error detection, which is unambiguously recited by Murata in the SOLUTION section, lines 13-16. Therefore, Applicant's arguments regarding the rejection of claims 14-16 are completely unpersuasive.

CONCLUSIONS

5. None of Applicant's arguments raised in Paper No.7/B regarding the previous rejections of claims 1-16 are persuasive. Therefore, the previous rejections of claims 1-3 and 13-16 are repeated in its original version, with some emphasis and citations added (underlined) to better elucidate the reasons for rejections. Note, these rejections are essentially the same as those recited in the first Office Action. So, they do not represent new grounds of rejection.

6. Upon careful review of the cited prior arts, the previous rejections of claims 4 and 6 are now withdrawn. Consequently, the previous rejection of claims 5 and 7-12, which either directly or indirectly depend on claim 4 or claim 6, are also withdrawn. This withdrawal is not a result of Applicant's argument.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishi (USPAT 5,003,342), hereafter to be addressed as Nishi-342.

► Regarding claim 1, Nishi-342 discloses a lithographic projection apparatus comprising:

- (a) an illumination system 2-4-5 shown in Fig.1 and Fig.3 for supplying a projection beam of radiation, as recited in Col.4/ll.35-45;
- (b) a first object table 6 for holding a projection beam patterning structure R capable of patterning the projection beam according to a desired pattern, as recited in Col.4/ll.45-50;
- (c) a second object table 9 for holding a substrate W (shown in Fig.1, recited in Col.4/ll.50-56) having a surface to be exposed, such that, when held on the table 9, the surface lies in a reference plane, i.e., on the same level as the diffraction grating 15, as recited in Col.5/ll.42-45;
- (d) a projection system 7, which images the patterned beam onto a target portion of the substrate W, as recited in Col.4/ll.50-55;
- (e) a positioning system 10 shown in Fig.1 which moves the second object table 9 between an exposure position shown in Fig.1 (on-axis), at which the projection system can image the patterned beam onto the substrate W, and a measurement position shown in Fig.3 (off-axis), as recited in Col.4/ll.56-60, Col.5/ll.67-68 & Col.6/ll.7, and Col.6/ll.23-35;

(f) a calibration system around 12 shown in Fig.1 or 13 shown in Fig.3, which is an interferometer system to measure lateral displacement of a reference point in a plane of the object table 9 as a function of tilt, at the measurement position, as recited in Col.4/II.61-68 and Col.8/II.10-30, wherein the calibration system around 12 in Fig.1 or 13 in Fig.3 comprises:

(g) a diffraction grating 15x and/or 15y as part of item 15 mounted to the second object table 9, as shown in Fig.1 and Fig.3 and recited in Col.5/II.40-50;

(h) an illuminator not shown in Fig.3 (to the left of light guide 21), which generates a measurement beam of radiation and directs the measurement beam through a reflector system 22-23 to be incident on the diffraction grating 15, so as to be diffracted thereby, as recited in Col.5/II.52-56; and

(i) a detector 19, which detects the position of the diffraction grating 15, as, recited in Col.5/59-66.

► Regarding claim 2, Nishi's diffraction grating 15 is transmissive, as disclosed in Col.5/II.45-56, and Nishi's calibration system around 12 (Fig.1) or 13 (Fig.3) further comprises a light guide 21, as recited in Col.5/II.53-56, which directs the measurement beam to be incident on the diffraction grating 15, as recited in Col.5/II.45-51, in a direction substantially independent of the tilt of the second object table 9, as is inherent and/or implicated in Col.6/II.23-35, i.e., with the system 21-22-23 detached from table 9.

► Regarding claim 3, Nishi's calibration system around 12 (Fig.1) or 13 (Fig.3) is constructed and arranged to measure displacements of a reference point FM on item 15 in the reference plane 9, as is inherent and conventional for an interferometer system,

and the diffraction grating 15x and 15y on item 15 is mounted parallel to the reference plane of the object table 9, as disclosed in Col.5/II.40-45 & 46-66.

► Regarding claim 13, Nishi's calibration system comprises a plurality of calibration systems, one around 12 (Fig.1) or 13 (Fig.3), another around 18 (Fig.1), as disclosed in Col.6/II.23-68 & Col.7/II.1-20, for measuring displacements of the second object table 9 with tilt (expressly recited in Col.8/II.10-14) about a plurality of axes (X and Y axes), as disclosed in Col.6/II.23-35 & 59-68, Col.7/II.1-68, Col.8/II.10-68 and Col.9/II.1-65.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishi-342, as applied to claim 1 above, and further in view of Ota (USPAT 5,831,739), Murata (JP-09199573 A) and Yamamoto et al. (USPAT 5,053,628).

► Regarding claim 14, Nishi-342 describes a *method of calibrating* a lithographic projection apparatus, comprising the steps of:

(a) measuring a position of a reference point on a surface of an object table 9 for holding a substrate W having a surface to be exposed, as shown in Fig.1 (on-axis) and Fig.3 (off-axis) as disclosed in Col.6/II.23-35 & 59-68, Col.7/II.1-68 and Col.9/II.1-65,

wherein the limitation of "*different tilts*" is a further generalization or expansion within skill in the art of the Nishi-342's specific recitation in Col.8/II.10-14;

(b) calculating a distance between the surface of the object table 9 and a rotation-invariant point of the object table, which is well known in the art as the "Abbe arm", as implicated in Col.9/II.20-52; and

(c) adjusting parameters of an electronic controller 20 included in the positioning system for moving the object table 9 between an exposure (on-axis) position shown in Fig.1 and a measurement (off-axis) position shown in Fig.3, as disclosed in Col.6/II.23-35 & 59-68, Col.7/II.1-20, and further in Col.8/II.9-68 and Col.9/II.1-20, so that the rotation invariant point is at a predetermined vertical distance from the reference point of the object table, as implicated in Col.9/II.44-59.

It is to be noted that Nishi-342's calibration method is much more sophisticated than Applicant's, involving the use of 2 interferometers and including steps not claimed in Applicant's invention. However, parts and steps that are not necessary may be simply discarded, and Nishi's method is still capable of performing everything that is claimed by Applicant, thus rendering Applicant's invention readily unpatentable over Nishi-342's.

As known to one ordinarily skilled in the art, all of Applicant's claimed limitations covered by Nishi-342's method are separately, specifically, and additionally, rendered obvious by Murata, as recited in the SOLUTION, lines 13-16, regarding the explicit measurement of the Abbe error, or Abbe arm, further by Ota, as shown in Fig.3,4 and 5, regarding the step of measuring different tilts by means of diffraction gratings MX_i and

MY_i shown in Fig.5, and the measurement of X (& Y) position by the laser interferometers 17 X (& Y) shown in Fig.3, as recited in Col.9/II.59-67 and Col.10-14; the latter being also obvious over Yamamoto et al., as shown in Fig. 1, 9, 13, 14 and 16 with regard to diffraction grating 6, wafer stage 3, and step motor 53, controlled by controller 52, as recited in Col.5/II.30-50 and Col.13/II.38-56.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to eliminate from Nishi-342's invention those elements (and their functions) that are not needed, or not desired, while retaining only the essential steps to practice Applicant's invention, as recited by Murata, Ota and Yamamoto et al., since it has been held by the Federal Court that "*omission of an element and its function is obvious if the function of the element is not desired*". *Ex parte Wu*, 10 USPQ 2031 (Bd. Pat. App. & Inter. 1989).

- Regarding claim 15, Nishi-342 describes a *method of manufacturing* a device using a lithographic projection apparatus, comprising the steps of:
- (a) providing a substrate W to an object table 9, as shown in Fig.1 and Fig.3, wherein the limitations that the substrate W is provided with a radiation-sensitive layer and having a target portions thereof, is trivial, for being conventional in the art and also inherent in Nishi's, as disclosed in Col.4/II.50-60;
 - (b) providing a projection beam of radiation using an illumination system1-4 shown in Fig.1 and Fig.3, as recited in Col.4/II.35-56;
 - (c) using a projection beam patterning structure R to endow the projection beam with a pattern in its cross section, as recited in Col.4/II.42-50;

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(d) moving the object table 9 to an exposure position shown in Fig.1, as recited in Col.5/ll.67-68 & Col.7/ll.1-22;

(e) projecting the patterned beam of radiation onto the target portions of the substrate W, as disclosed in Col.4/ll.50-53; and

(f) detecting displacements of a reference point of the second object table at various angles of tilt when situated at the measurement position, as is inherent in Nishi's and further rendered obvious by Murata, Ota and Yamamoto et al., as already applied to claim 14 above.

► Claim 16 is a Product by Process claim depending on the process claim 15 that has been previously rejected. Claim 16 would have been allowed if claim 15 were allowed, which is here not the case. Therefore, claim 16 is rejected by the same reasons and over the same prior arts as previously applied to the parent claim 15.

9. **New** claims 17 and 19 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Nishi-342 in view of Ota, Murata and Yamamoto et al.

Nishi-342 as modified by Ota, Murata and Yamamoto et al. show all the limitations of claims 17 and 19, as previously applied to the parent claims 14 and 15, except for the additional limitation of directing a measurement beam to a diffraction grating provided on the object table, independent of the tilt of the object table.

Nishi-342 directs a measurement beam through 22, 23 to a diffraction grating (15x and 15y on) 15, as shown in Fig.3 and recited in Col.5/ll.39-52. Nishi-342's

measurement beam is provided by a optical fiber 21, and is therefore independent of the tilt of the object table 9.

Final Rejection

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Allowable Subject Matter

11. Claims 4 and 6 are allowable for reciting the limitation of a plurality of reflectors, or a retro-reflector "*mounted ... behind the diffraction grating relative to the illuminator and positioned to reflect the measurement beam passing (back) through the diffraction grating (in a direction opposite to the incident path)*".

In this respect, Nishi-342's reflector 23 in Fig.3 is neither a retro-reflector nor a corner cube, whereas Nishi-885's (USPAT 6,331,885) corner cube(s) 31Y1, 31Y2, and 31Y3 shown in Fig.4 and Dirksen's (USPAT 5,917,604) retro-reflector 44 shown in Fig.1, which have been previously applied for rejecting claims 4 and 6, are not "*mounted behind the diffraction grating relative to the illuminator and positioned to reflect the measurement beam passing (back) through the diffraction grating (in a direction opposite to the incident path)*", as recited in the claims.

Therefore, claims 4 and 6 are allowable, and consequently also claims 5 and 7-12, due to their direct or indirect dependencies on claim 4 or claim 6.

12. **New** claims 18 and 20 are also allowable for reciting the limitation of "*directing a measurement beam along an incident path substantially perpendicular to a diffraction grating ... and reflecting the measurement beam along a return path substantially parallel to the incident path and passing through the diffraction grating in a direction opposite to the incident path*". Similar to claims 4 and 6, this limitation is neither anticipated nor rendered obvious by any prior art.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305 0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes

May 28, 2003


JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800